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NATIONAL EXAMINATION 2002/2003

SUBJECT : MATHEMATICS VII

LEVEL : TRONC COMMUM

DURATION : 3 HOURS

INSTRUCTIONS :

- This paper consists of **TWO** Sections **A** and **B**.
- Attempt **ALL** the questions in Section **A** and any **THREE** questions in Section **B**.
- Show **ALL** the working clearly.
- Calculators may be used.

SECTION A: /55 Marks

1. (a) Evaluate: $\frac{3.5^2 - 1.5^2}{0.2}$. (2marks)

(b) Simplify completely the following: $(2\frac{1}{7} \div 1\frac{1}{2}) + \frac{2}{3}$. (2marks)

2. Rationalize the denominator: $\frac{10}{3\sqrt{2} - \sqrt{3}}$. (3½marks)

3. Given that $g(x) = x^2 + 2x$ and $f(x) = x + 1$,

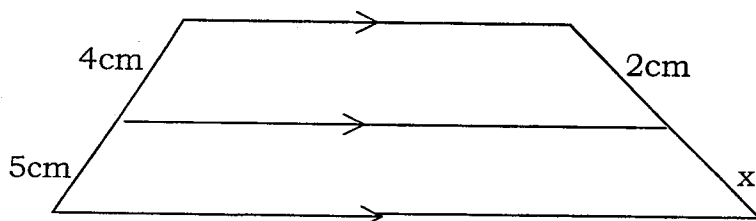
(a) determine $gf(x)$. (2marks)

(b) solve for x given that $g f(x) = 0$. (3marks)

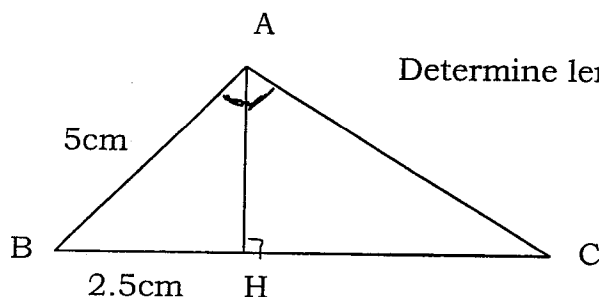
4. (a) y varies inversely as x . Given that $y = 3$ when $x = 5$, find the value of y when $x = 4$. (2marks)

(b) A line segment, 18cm long, is divided in the ratio 2: 3: 4. How long is each part? (2marks)

5. (a) From the diagram below, find the length x . (1½marks)



(b)



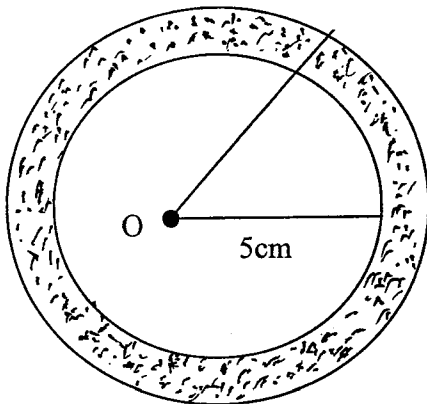
Determine length \overline{BC} in the diagram on the left.

(2marks)

6. Solve the following simultaneous equations: $2x + 3y = 3$
 $3x + 5y = 4.$

(3marks)

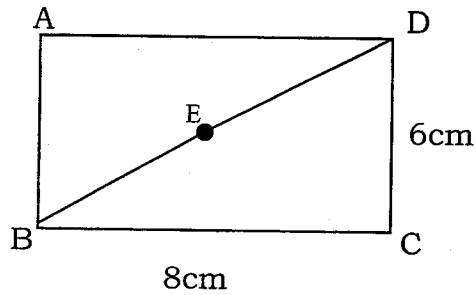
7.



O is the centre of the two circles. The radius of the smaller circle is 5cm and the area of the shaded part is 235.5cm^2 . Calculate

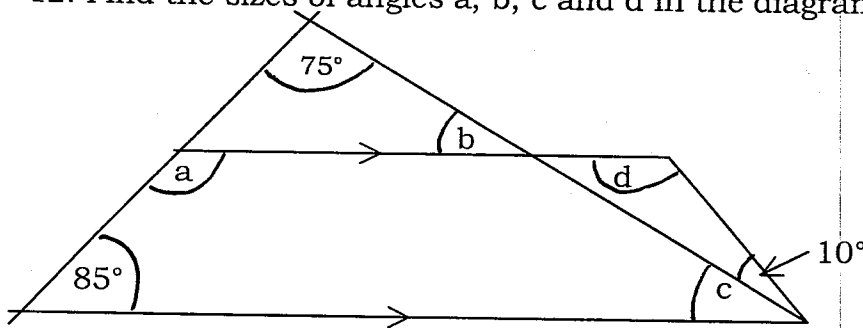
- (a) the radius of the larger circle. **(2½marks)**
- (b) the circumference of the larger circle. Take $\pi = 3.14$. **(1mark)**
8. Solve the inequality: $\frac{1}{4}m - (m + 1) \geq 2$. **(2½marks)**
9. (a) Given that vector $\vec{a} = \begin{pmatrix} 5 \\ 2 \end{pmatrix}$, and vector $\vec{b} = \begin{pmatrix} 15 \\ x \end{pmatrix}$, find the value of x if \vec{a} is parallel to \vec{b} . **(2½marks)**
- (b) Calculate: $2\vec{a} + \vec{b}$. **(1mark)**
10. (a) The area of triangle ABC is 12cm^2 . Calculate the area of the triangle formed by enlarging the triangle ABC with a scale factor of 3. **(1½marks)**
- (b) What properties of the triangle ABC after enlargement
- (i) remain the same. **(1mark)**
- (ii) change. **(1mark)**

11. The figure ABCD is a rectangle. E is the midpoint of the diagonal \overline{BD} .



- (a) Which angle is the same size as angle ADB? **(½mark)**
- (b) What can you say about triangle ADB and triangle CBD? Give reasons for your answer. **(2marks)**
- (c) Calculate length \overline{ED} . **(1½marks)**
- (d) How many lines of symmetry does the figure ABCD have? **(½mark)**

12. Find the sizes of angles a, b, c and d in the diagram below.



(4marks)

13. (a) Simplify the algebraic fraction completely:

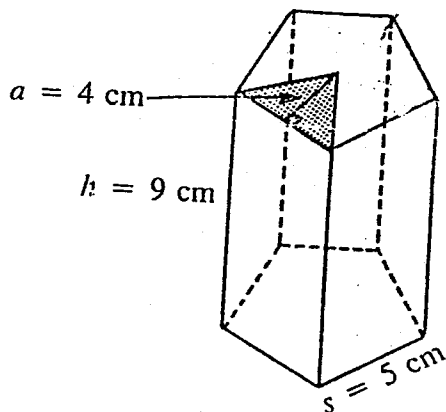
$$\frac{2}{a+2} - \frac{a-6}{a^2-4}$$

(3marks)

- (b) Given that $\frac{1}{m} = \frac{1}{m_1} + \frac{1}{m_2}$, make m the subject.

(2½marks)

14. The figure below is a prism with a regular pentagon base.



Calculate (a) the total surface area of the prism.

(2½marks)

(b) the volume of the prism.

(1½marks)

15. Find base n if $201_n - 34_n = 134_n$, $n \in \mathbb{N}$.

(2½marks)

SECTION B:

/45 Marks

16. (a) (i) Factorize and simplify completely the algebraic

fraction: $\frac{4x^4 + 24x^3 + 36x^2}{x^4 - 9x^2}$, $(0, 3, -3 \notin x)$.

(6marks)

(b) Solve for x : $3x^3 + 28x^2 + 63x + 18 = 0$, $x \in \mathbb{R}$.

(9marks)

17. A teacher found that students were taking too long to answer a statistics question in every mathematics examination. He asked pupils to answer a statistics question and he recorded how long it took each pupil. Below are the times in minutes the teacher recorded.

29	31	32	35	32	31	39	35
35	34	26	32	26	32	35	39
39	29	39	34	29	39	39	26
26	35	27	32	32	34	31	39

(a) Draw a frequency table for this data.

(4marks)

(b) How many students were involved in the test?

(½mark)

- (c) Find the mode time. **(½mark)**
- (d) The statistics question is worth 15% of the total marks in a three hour mathematics examination paper.
- (i) How long should each student be spending on the statistics question? **(1mark)**
- (ii) What percentage of the students are spending too long on the statistics question? **(2marks)**
- (e) How many students spent
- (i) the longest time? **(½mark)**
- (ii) the shortest time? **(½mark)**
- (f) Draw a histogram to show the information of the data. **(6marks)**
18. The vertices of triangle ABC are A(-3,0), B(-1,-2) and C(1,1).
- (a) On a Cartesian plane plot points A,B and C. Join the points to form triangle ABC. **(3½marks)**
- (b) $T = \begin{pmatrix} 6 \\ 2 \end{pmatrix}$ is a translation.
- (i) Write the coordinates of A', B' and C' the images of A, B and C under translation T. **(3marks)**
- (ii) Plot the coordinates of points A', B' and C' on the same Cartesian plane as that of question 18(a). Join the points to form triangle A' B' C'. **(2½marks)**
- (iii) What has changed about triangle ABC after translation? **(½mark)**
- (iv) Which properties of triangle ABC have remained the same under translation T? **(1½marks)**
- (c) (i) Write the coordinates of A'', B'' and C'' the images of points A, B and C after reflection in y-axis. **(1½marks)**
- (ii) Plot the points on the same Cartesian plane as of 18(a). Join the points to form triangle A'' B'' C''. **(2½marks)**

19. (a) The value of a car depreciates by 10% of its value each year.
A car was valued at 5 500 000frw on 1st January, 2000.

Calculate (i) the value of the car as at 1st January, 2002. **(2marks)**

(ii) the loss in value of the car as at 1st January, 2003. **(3marks)**

- (b) A man invested 200 000frw in a bank at 5% per year simple interest. Calculate

(i) the interest due at the end of 21 months. **(2marks)**

(ii) the time for the investment to amount to 240 000frw. **(3marks)**

- (c) A customer paid 8 400frw for a pair of shoes after a sales tax of 12% was added to the marked price.

(i) Calculate the cost price of a pair of shoes without tax. **(1½marks)**

(ii) If a customer paid 50 400frw, find the number of pairs of shoes the customer bought and the sales tax paid. Take sales tax as 12%. **(2marks)**

- (d) A school boy bought school uniform. The cost price of the uniform was 5 000frw and a 15% sales tax was added. The boy was given a discount of 5%. How much money did the boy pay for the uniform? **(1½marks)**

20. (a) Given the points A(2,1) , B(4, 2) and C(6, 3),

(i) show that the three points lie on the same straight line. **(3marks)**

(ii) show that point B is the midpoint of line \overline{AC} . **(2marks)**

(iii) determine the length of line \overline{AC} . **(2marks)**

(iv) if D is (0,5), show that triangle ACD is an isosceles triangle. **(3marks)**

- (b) (i) Find the coordinates of H, the midpoint of line \overline{CD} . **(2marks)**

(ii) Calculate the area of triangle A C D. **(3marks)**

SECTION C:

21. If you are only given distilled water, (H₂O) dilute hydrochloric acid (HCl), solid Sodium Carbonate (Na₂CO₃), Zinc metal (Zn) and Magnesium Sulphate solid (MgSO₄)

N.B: The order of reactivity series is Sodium, Magnesium, Zinc and Hydrogen.

By use of equations, outline how you would prepare pure samples of:

- (a) Zinc Carbonate.
- (b) Magnesium chloride.

(7½marks)

(7½marks)

22. Read the following passage and answer the questions that follow.

To a black powder A was added dilute H₂SO₄ and a blue solution B was formed. When NaOH solution was added to B, a blue precipitate C was formed. When C was strongly heated the black powder A was formed. When Na₂CO₃ solution was added to B a green-blue precipitate D was formed. When D was strongly heated, the black powder A was formed.

(a) Name and write the formulae of substances A, B, C and D.

(8marks)

(b) Write balanced equations for the reactions mentioned in the passage.

(7marks)

23. (a) With the aid of a well labelled diagram, describe an experiment to prepare chlorine gas from Manganese IV oxide (MnO₂).

(9marks)

(b) Write equations to show how Cl₂ reacts with:

- (i) Iron (Fe)
- (ii) Iron II chloride (FeCl₂)
- (iii) H₂O
- (iv) NaOH

(4marks)

(c) State two uses of Chlorine.

(2marks)